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EVALUATION OF T-RATIONS
AND THE MOBILE FOOD
SERVICE UNIT
IN A FIELD EXERCISE:
FORT BRAGG, NC



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Recognizing that the Army's present Combat Feeding System is ill-suited to the battlefield conditions anticipated in future conflicts, a new concept was developed. This report presents the results obtained in the second field evaluation of key elements of the proposed combat feeding concept, the Mobile Food Service Unit (MFSU) and the T-ration. Three major conclusions are drawn from the evaluation. First, the T-ration proved to be an acceptable field ration. Next, the concept of heating, delivering, and serving the T-ration from the MFSU proved viable. Finally, the MFSU can be efficiently operated by two personnel.		

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PREFACE

This field evaluation was conducted as part of the Department of Defense Food Research, Development, Test and Engineering Program (RDT&E) under the Joint Service Requirement, AMAF 81-20, "Advanced Concepts for Combat Food Service Systems", Appendix 1, "Evaluation of the Army Combat Field Feeding System".

Several individuals at the U.S. Army Natick Research and Development Laboratories made notable contributions to various phases of the evaluation described in this report. The efforts of Mrs. Barbara Bell of the Science and Advanced Technology Laboratory, Behavioral Sciences Division, who collected the requisite data and furnished the analytical results on food acceptance are appreciated. The successful performance of the prototype mobile food service unit in this evaluation is attributed in large measure to the overall guidance and efforts of Mr. Cornelius McKeown of the Aero-Mechanical Engineering Laboratory. The technical support provided by Mr. Joseph Mackoul of the Aero-Mechanical Laboratory, Mr. Bruce Thomas and Mr. David Corfield of the Food Equipment Laboratory is also appreciated.

Special acknowledgement is made to COL Raphael J. Hallada, the 82nd Airborne Division, Artillery Commander, for his support throughout the evaluation. The efforts of the Division Food Advisor MSG Weaver in coordinating the planning and on-post support for NLABS is appreciated and, in particular, thanks are extended to the operators of the MFSU SGT Williams and SGT Miller of the 319th Field Artillery for their extra time and personal involvement with the evaluation.

Special appreciation is extended to Ms. Deborah Brooke and Ms. Lauren Wiles who have provided excellent secretarial support to this project, and to Mrs. B. Joyce Barrett and Mrs. Judith Tamburro who composited the final version.

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EVALUATION OF T-RATIONS AND THE MOBILE FOOD SERVICE UNIT IN A FIELD EXERCISE AT FORT BRAGG, NC

I. BACKGROUND

It has been recognized that the present Army Combat Feeding System is labor intensive and relatively immobile. Two technical reports were published by NLABS relative to this subject: A Proposed System for Army Combat Forces in the 1990's, Technical Report NATICK/TR-78/025, May 1978¹ and A Proposed Combat Food Service System Concept for the Army in 1990, Technical Report NATICK/TR-80/027 ORSAO, January 1980.² Another report on the subject, Combat Field Feeding System - 1990's was published by the U.S. Army Quartermaster School, Fort Lee, VA in August 1980.³ The new concept has provisions for feeding at three levels of commitment and has provisions for feeding under different combat conditions and for hospital needs, squads and individuals in combat vehicles and on the ground.

The Combat Field Feeding System (CFFS) consists of a Tactical Field Kitchen (TFK) which includes a Mobile Food Service Unit (MFSU) and a Supplemental Field Kitchen Kit (SFKK). The MFSU contains components operational on the ground, on a trailer, truck, or a similar combat vehicle. The MFSU has the capability to heat and serve food items packaged in their original container. When these containers, or "Tray Packs", are used to serve a complete meal, the meal is referred to as a T-ration meal. The SFKK provides the capability to prepare and serve the T-ration, limited A-rations, and has a sanitation capability. When three or more TFK's are combined they are called a Consolidated Field Kitchen (CFK) and can provide food service at the battalion level.

The equipment and operations of SFKK have been used successfully in previous Army tests and with other services. The unique and key parts of the Combat Food Service System are the MFSU and the T-ration meal. Thus, it is necessary to evaluate these items in a field environment to validate the concept. One concept evaluation has been completed with the MFSU and the T-ration meal with a combat engineer battalion at Fort Devens, MA. The results of that evaluation, which were highly successful, are available in NLABS Technical Report NATICK/TR-82/043.⁴ This technical report documents a second evaluation with the 82nd Airborne Division Artillery, Fort Bragg, NC during the period 23 to 27 Oct 81.

¹ R.J. Byrne, "A Proposed System for Army Combat Forces in the 1990's," Technical Report, NATICK/TR-78/025, US Army Natick R&D Laboratories.

² R.J. Byrne, S. Baritz, R. Decareau, G. Hertwick, H. Kirejczyk, I. Nii, "A Proposed Combat Food Service System Concept for the Army in 1990," Technical Report, NATICK/TR-80/027, January 5, 1980, US Army Natick R&D Laboratories.

³ US Army Quartermaster School, "Combat Field Feeding System Final Report," Final Report and Appendices, August 1980.

⁴ J. Wall, D.P. Leitch with E. Comstock, "Evaluation of T-Rations and the Mobile Food Service Unit in a Field Exercise: Fort Devens," Technical Report, NATICK/TR-82/043, September 1982, US Army Natick R&D Laboratories.

The T-Ration

The T-ration consists of a combination of fully prepared thermostabilized food packed in containers with the configuration of the half-sized steam-table pan. Because the tray is flat, prepared foods that were not practical in cylindrical cans can now be served. Figure 1 shows some examples of T-rations. Lasagna, stuffed cabbage, stuffed peppers, salisbury steak, BBQ beef, and chicken breasts are typical items available.

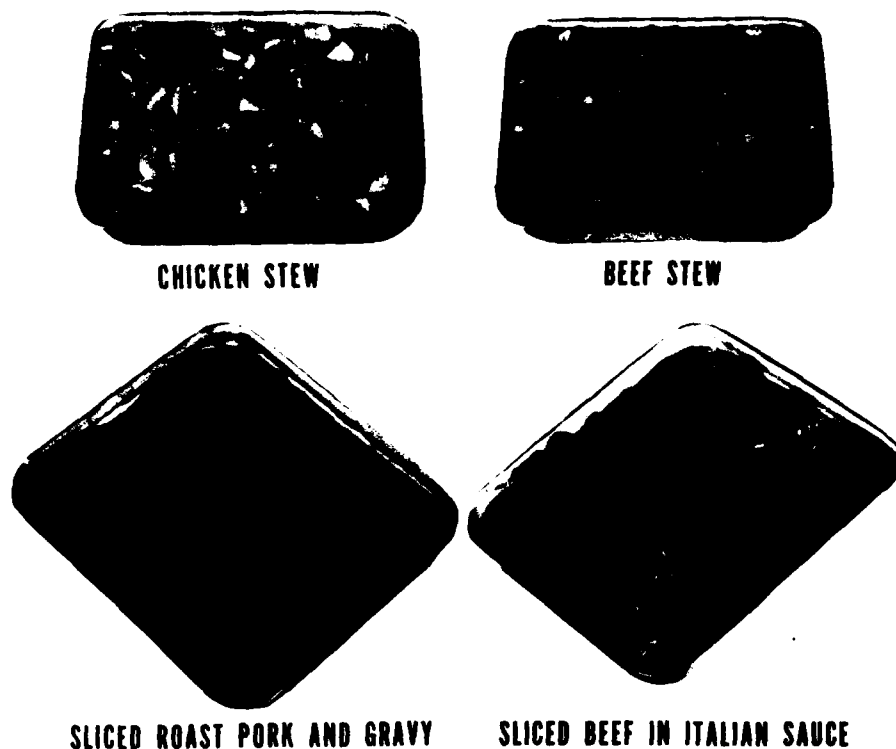


FIGURE 1. T-RATION ITEMS

Figure 1. T-Ration Items

The Tray Pack is a recent concept in food packaging, originating with a breakthrough in packaging — the formation of a smooth-wall foil container of single serving size that could be hermetically sealed and thermally processed. Subsequent investigation and development work led to the introduction of a heavier duty, drawn container of multiservice size, that is, a half-size steam-table container that holds 8 to 24 servings. In volume it is about the capacity of a No. 10 can, or 105 fluid ounces, and is designed to fit into a 12" x 20" steamtable top with two trays side by side per opening. The tray construction is one piece with a step shoulder on the wall to support it in the table top opening and it is fabricated from precoated sheet steel by the drawn/redrawn method of manufacture. The tray lids are designed for double seaming with conventional can closing machinery to form a positive hermetic seal. The double seam allows opening with most standard can opening devices.

The flat shape of the container reduces thermal process and reheat times. Studies show that food in the tray container takes less than 50% of the time to heat than identical food packed in a No. 10 can. This translates into a savings in time and energy resulting in better food quality.

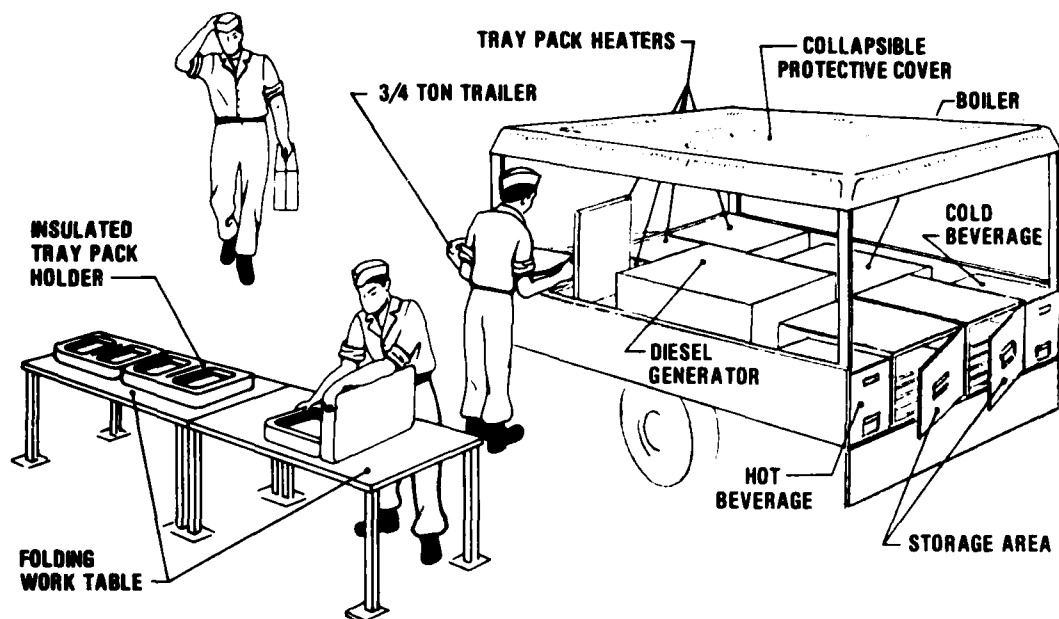
The Tray Pack is ideal for a military field application because it requires no refrigeration. The Tray Pack has an acceptable shelf life, stores easily, and since it requires only to be heated and opened to be served, it significantly reduces labor requirements. Also, the container is disposable, thus reducing sanitation requirements.

The Mobile Food Service Unit

In February 1981 a Letter of Agreement (LOA) for a combat field feeding system was formulated between NLABS and the US Army Training and Doctrine Command (USATRADO). The LOA called for the development of a MFSU designed to heat, deliver and serve the T-ration meal with a beverage to troops in forward areas. The LOA requires the MFSU to have the following basic features or capabilities:

- It must be able to heat T-rations packaged in a container approximately 10 x 12 x 3 inches from 25°F to 170°F in less than 30 minutes.
- It must be large enough so that sufficient rations may be heated to feed up to 120 people at one time.
- The equipment is to be skid-mounted and be suitable for use on a 2½-ton truck bed or its replacement vehicle, on a 1½ ton trailer, and on the ground.
- The unit is to be fully operational for meal service within ten minutes of arrival at the feeding site.
- The unit is to take no more than 10 minutes to be fully prepared for movement to the next site.
- The unit is to have a means to protect the equipment and serving line from the environmental elements during transportation, food heating and serving operations.
- The unit is to be capable of transporting and storing 120 gallons of potable water and to be able to dispense it through no less than four outlets.

Figure 2 depicts the mobile Food Service Unit as originally conceived. Although the experimental prototype used differed in certain details, the main components remained as indicated in the figure.



MOBILE FOODSERVICE UNIT

Figure 2. Mobile Food Service Unit



Figure 3. 'he MFSU' the Field

The components of the MFSU included a generator, a boiler, the hot water tank, an insulated container for holding heated Tray Packs at serving temperature, insulated containers for dispensing hot and cold beverages, folding utility tables, a serving table and a wooden container for holding and dispensing disposables. Figure 3 shows the 1½-ton trailer that held the MFSU components while a T-ration meal was being served in the field at Fort Bragg. The trailer was towed by a 2½-ton truck which is also pictured. Each of the components of the MFSU are portable and can be handled by two people.

II. CONCEPT EVALUATION METHODOLOGY

The concept evaluation was conducted from 23 through 27 October 1981. The plan called for serving one T-ration meal per day for five days in a field environment to Alpha Battery, 319th Field Artillery Battalion of the 82nd Airborne Division Artillery. The breakfast meal was to be prepared in the dining hall and transported in insulated containers to the field. The noon meal called for individual rations, MCI's and 80 to 100 people would be served a T-ration meal in the evening. No field kitchen was to be used.

Menu

In addition to the MFSU, NLABS provided the Tray Packs to be used along with the compartmented paper trays, plastic knives, forks and spoons. The planned five-day menu for the T-ration meal appears in Figure 4. Beverages and bread were provided by the 319th Artillery Battalion.

Day 1	Salisbury Steak Stew Cut Potatoes Green Beans Cherry Dessert	Day 2	Roast Pork Baked Beans Corn Apple Dessert
Day 3	Beef Tips w/Gravy Scalloped Potatoes Peas Cherry Nut Cake	Day 4	Chicken Cacciatore Stew Cut Potatoes Lima Beans Peach Dessert
Day 5	Roast Beef German Potato Salad Corn Blueberry Dessert		

Figure 4. Menu

Data Collection Plan

As in the previous evaluation, the data collection plan focused on manpower, customer acceptance of the meals served, and the operation of the MFSU components. Positive feed-back on these three items was again deemed essential to any determination of concept viability. Thus, these major questions guided the planning effort:

1. Can the MFSU be operated by only two food service personnel?
2. Is the T-ration meal acceptable to Army troops in the field?
3. Will the experimental prototype MFSU perform to design levels in terms of time to heat rations, reliability, etc.?

At the Fort Devens evaluation these questions were answered in the affirmative. This evaluation was conducted to confirm that information in a different environment, with troops on a different mission and to provide additional baseline data for future developmental decisions.

Manpower

Prior to the evaluation, NLABS requested the services of two cooks to operate the MFSU during the evaluation. The cooks were given an overview of the MFSU components, the expected method of operation, and a briefing on the Tray Packs. As with the Fort Devens evaluation, it was decided to allow two cooks (considered to be the necessary manpower) to operate the MFSU and to note any deficiencies indicating additional manpower requirements.

T-Ration Acceptability

The acceptability of the Tray Pack products by the customers was collected by interviewing customers at the feeding site as they completed the meal. A nine-point scale was used to rate food acceptability with "1" reflecting "dislike extremely" and "9" indicating "like extremely". A representative number of customers were interviewed at each T-ration meal and also at one MCI meal. Food acceptance ratings were obtained at each T-ration meal for the entree, vegetable, starch, dessert and overall meal.

Portion data were collected to develop information on the number of servings that can be expected from Tray Packs in field conditions. These data were collected by counting the number of disposable compartmented trays that were used and the number of Tray Packs used. This indicated the number of meals served and the amount of food used. No particular effort was made to control portion size.

MFSU Components

During the Fort Devens evaluation two experimental prototypes of the MFSU were used. Both had holding tanks referred to as the "tray ration converter" for hot water. The Tray Packs were placed into the hot water and brought up to serving temperature. The major difference in the units was that one had an integral heater while the other had a separate heater. The unit with the separate heater was preferred and selected for use in this follow-on evaluation. Figure 5 depicts the components of the MFSU and the flow of water through the system.

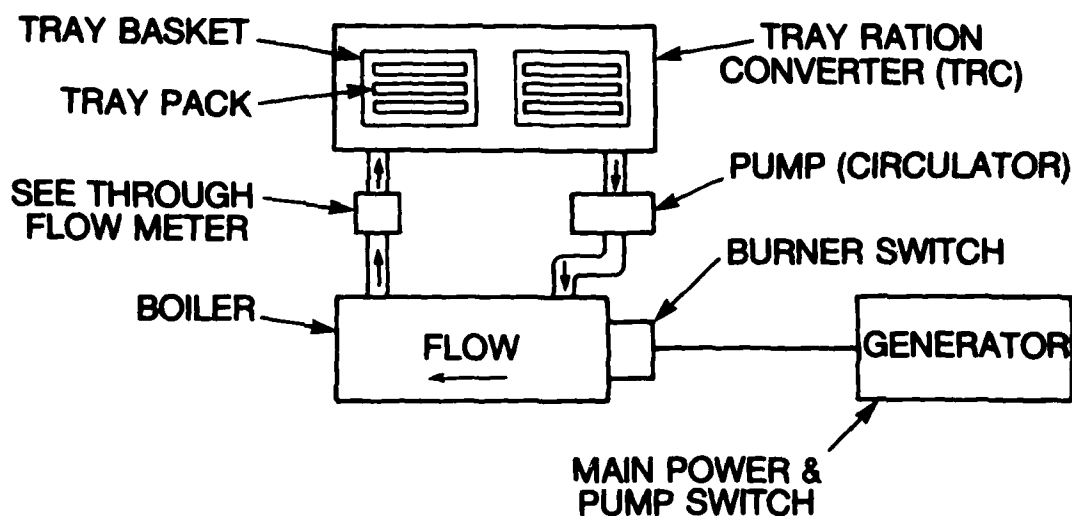


Figure 5. MFSU Components

The MFSU components were mounted on a 1½-ton trailer and transported from NLABS to Fort Bragg on a flatbed truck. Some damage to the unit occurred during shipment; however, it must be kept in mind that this unit is an experimental prototype and not a "hardened" field model. A contract has been awarded to Dynamic Science, Inc. to fabricate the units that will be used in the Force Development Test and Evaluation (FDT&E) scheduled for October 1982. Even though not a sophisticated model, the damage was minor, and with the excellent support of the 319 AFTY BN motor pool, all repairs were made and the projected schedule was maintained.

III. RESULTS AND DISCUSSION

Customer Evaluations

The overall rating shows the T-ration meal to be highly acceptable to the troops in the field. In fact, this rating is even higher than experienced at Fort Devens as shown in Table 1.

Table 1

Food Acceptance Ratings at Fort Bragg and Fort Devens

	Fort Devens	Fort Bragg
Meal Overall	7.2	8.3
Entree	7.2	8.1
Starch	6.8	7.6
Vegetable	6.7	7.9

It is noted that the T-ration meal served at Fort Bragg was the evening meal while the T-ration meal served at Fort Devens was the noon meal. At Fort Devens the evening meal was an A-ration meal and rated lower than the T-ration meal. The overall rating of the Fort Devens A-ration meal was 6.2.

The conditions at Fort Bragg were more difficult than those at Fort Devens because of the frequent moves and often times heavy rain during three days. Yet, under these more adverse conditions the ratings were higher. Table 2 displays the detailed breakdown of the food acceptance data.

MFSU Performance

The MFSU performed its mission without the slightest difficulty or problem. The same two cooks operated the unit at each meal. They were provided with training the first day and thereafter operated without assistance or instruction.

Since a contract had been awarded to have additional units fabricated, this opportunity was seized to have contractor representatives present to gain firsthand knowledge of the MFSU/Tray Pack concept in operation. The contractor representatives observed the complete operation of the unit for two days which included preparation of the unit for use, transport to the serving site, setup, serving, repack, transport to subsequent sites and return to the starting point, and cleanup in preparation for the following day.

The two personnel assigned to operate the MFSU were outstanding workers. After the first day they operated the MFSU with little or no supervision.

MFSU Setup and Repack Times

From the outset, the goal for setup and repack times was ten minutes for each. Since the unit is experimental, some of the equipment could not be handled as efficiently as will be possible on production models. This was the case at Fort Devens where setup times ranged from 5 to 16 minutes with the average time between 10 and 11 minutes. Repack was much better with times ranging from 5 to 12 minutes with the average between 7 and 8 minutes. At Fort Bragg the setup times ranged from 7 to almost 13 minutes. Of the seven times recorded, four were less than 10 minutes and two others were less than eleven minutes. The exact times are listed in Table 3.

Table 2
Detailed Food Acceptance Data

Fort Bragg

Tray Packs

Day	Date	Entree	Mean	Vegetable	Mean	Potato	Mean	Compo- Dessert	Mean	Bread Mean	Kool-Aid Mean	Coffee Mean	Overall Meal Mean
1	Friday 23 Oct 81	Salisbury Steak	8.40	Green Beans	7.64	Stew Cut Potatoes	8.00	Cherry	8.52	7.81	8.59	6.75	8.72
2	Saturday 24 Oct 81	Roast Pork	8.18	Corn	8.29	Baked Beans	8.15	Apple	8.79	8.29	8.09	8.54	8.46
3	Sunday 25 Oct 81	Beef Tips w/Gravy	8.09	Peas	7.90	Scalloped Potatoes w/Ham	7.27	Cherry Nut Cake	7.35	7.95	8.62	8.57	8.00
4	Monday 26 Oct 81	Chicken Cacciatore	7.96	Lima Beans	7.47	Stew Cut Potatoes	7.00	Peach	8.39	8.05	8.64	9.00	8.04
5	Tuesday 27 Oct 81	Roast Beef	7.96	Corn	8.04	German Potato Salad	7.56	Blueberry	8.00	8.29	8.50	8.57	8.30
MCIs													
3	Sunday 25 Oct 81	Entrees	4.49	Fruits	6.59	Cheese	4.35	Desserts	5.55	Candy	Peanut Butter	Cocoa Bev	
						Cheese & Crackers	5.33	Crackers	3.86	5.77	5.00	7.00	

Table 3

MFSU Setup Times

Day	Stop 1	Stop 2	Stop 3
2	9:42	10:57	
3	10:43	12:49	
4	8:50	7:21	9:05

Day 1 is not included on Table 3 because Day 1 was primarily a training, get acquainted day and the time measurement would not be meaningful. Day 5 is also omitted because the exercise was called to a halt at the time of departure to this field location. The final meal was served to the troops as they returned; however, the setup and repack times were not recorded since there was no longer a demand on their time. Table 4 reflects the repack times at several stopping points along the test route.

Table 4

MFSU Repack Times

Day	Stop 1	Stop 2	Stop 3
2	5:45		
3	10:27		
4	10:24	6:01	

Repack at this time was casual and intermittent as troops showed up after repack began and the cooks had a meal during repack time.

Again, while performance was not demanded to be within the specified 10 minutes, the times are within range of this objective. In all likelihood, future setup and repack times will be improved with refinement.

Serving and Total Times

Serving and total times were recorded and reported for Fort Devens and it was noted that travel, setup and repack times are unaffected by the number of troops to be served. Setup and repack times must be kept to a minimum, so that upon arrival, the troops do not have to wait and when serving is finished, the unit can quickly move on to the next location. However, serving and total time are dependent on the number of troops served and the distances

between locations. Added to this are delays due to the combat environment. Troops often maintain a five-meter separation in the approach to the serving table. This slows the number that can be served. Other times the serving is interrupted and later resumed due to a call to duty or troops are delayed in being released from their positions. There are too many variables affecting serving time to make any statement on meals per minute or any other flow-through, rate measurement. Keeping in mind that the MFSU is providing a hot meal that would not otherwise be available, the time factor for serving and travel is of lesser importance.

Disposables

NLABS also furnished the disposable products used during this evaluation. These included a GSA compartmented paper tray, plastic knives, forks, and spoons. Plastic bags were also included and used for trash collection. Table 5 lists the disposables used. They were found to be satisfactory.

Table 5

Disposable, NSN and Cost

Item	NSN	Unit Pack	Unit Cost
Paper Tray	7350-01-012-8787	500	20.90
Plastic Fork	7340-00-022-1315	100	1.95
Plastic Knife	7340-00-022-1316	100	1.95
Plastic Spoon	7340-00-022-1317	100	1.80
Plastic Bag	8105-00-655-8286	125	16.80

T-Ration Cost and Portions

The number of Tray Packs and paper trays used was recorded to determine the number of portions from each tray. This information is essential for planning the number of Tray Packs required to feed a given number of troops. Portion size was not controlled because it is assumed that portions will not be controlled under combat conditions. As a rule of thumb in estimating the Tray Pack requirements for this evaluation, it was assumed that an entree would serve ten, and the starch, vegetable and dessert Tray Packs would serve twenty. The portions per Tray Pack, as recorded, follows in Table 6. The portions per Tray Pack are derived by dividing the number of trays used by the number of troops served. Thus it is a recording of portions at this exercise and not related to controlled portions measured in ounces per serving. It is assumed the baked beans were not popular which accounts for the high number of portions per tray.

Table 6

**Menu Items, Tray Packs Used, Number Served and Portions
Per Tray Pack at Fort Bragg**

Menu Items	No. Trays Used	Number Served	Portions Per Tray
Salisbury Steak	4	42	10
Roast Pork	6	91	15
Beef Tips w/Gravy	7	86	12
Chicken Cacciatore	8	89	11
Roast Beef	5	66	13
Stew Cut Potatoes	7	131	18
Baked Beans	2	91	45
Scalloped Potatoes	7	86	12
German Potato Salad	4	66	16
Green Beans	2	42	21
Corn	10	157	15
Peas	6	86	14
Lima Beans	6	89	14
Cherry Dessert	3	42	14
Apple Dessert	5	91	18
Cherry Nut Cake	5	86	17
Peach Dessert	6	89	14
Blueberry Dessert	4	66	16

The above figure shows that rule of thumb was not accurate in this instance. Figure 6 shows average portions per tray at Fort Devens and at Fort Bragg.

Table 7

**Portions Per Tray Pack Container at Fort Devens
and Fort Bragg**

Fort Devens		Fort Bragg	
Item	Average Portions	Item	Average Portions
Entree	11	Entree	11
Starch	16	Starch	20
Vegetable	17	Vegetable	23
Dessert	14	Dessert	17

Thus, the new figures for estimating the number of portions per tray for field feeding appear to be: Entree 11, Starch and Vegetable 16, and Dessert 14. These are general estimations. Planners should keep in mind that individual item packs vary, e.g., there are ten whole chicken legs in a container, salisbury steak is packed twenty to a container, lasagna has nine servings etc., and thus, to provide for a margin of error planning estimates of ten portions per entree, twenty per starch and vegetable, and 15 per dessert should be used. As noted on Table 6 the dichotomy between the portions per Tray Pack for the two evaluations precludes a definitive statement on portions at this time.

Since data are now available from two evaluations, it is useful to record the average portions per Tray Pack on the items that were served at both locations. That information follows in Table 8.

Table 8
Average Portions Per Tray Pack of Like Items at
Fort Devens and Fort Bragg

Item	Fort Devens	Fort Bragg
Roast Beef	13	13
Stew Cut Potatoes	24	18
Scalloped Potatoes	18	12
Baked Beans	19	45
Green Beans	24	21
Lima Beans	26	14
Corn	19	15
Apple Dessert	13	18
Cherry Dessert	18	14
Blueberry Dessert	17	16

The cost per serving and per meal are very much a function of the portions per tray. Table 9 below displays the cost per serving and the cost per meal for each of the Tray Pack meals served. The average cost per meal at Fort Bragg was \$2.35 while at the Fort Devens evaluation it was \$2.06.

Table 9

**Cost of Tray Pack Components and Cost of the Total Meal
at Fort Bragg (Sep 81)**

Day	Item	Cost Per Tray	Portion Per Tray	Cost Per Serving
1	Salisbury Steak	10.16	10	1.02
	Stew Cut Potatoes	5.80	21	.28
	Green Beans	6.05	21	.29
	Cherry Dessert	7.67	14	.55
				<u>2.14</u> Cost per meal
2	Roast Pork	15.60	13	1.20
	Baked Beans	4.66	45	.10
	Corn	5.80	18	.32
	Apple Dessert	7.43	18	.41
				<u>2.03</u> Cost per meal
3	Beef Tips w/Gravy	14.23	12	1.18
	Peas	5.80	14	.41
	Scalloped Potatoes	7.55	12	.63
	Cherry Nut Cake	7.55	17	.49
				<u>2.71</u> Cost per meal
4	Chicken Cacciatore	9.11	11	1.83
	Lima Beans	5.80	14	.41
	Stew Cut Potatoes	5.80	17	.34
	Peach Dessert	7.43	14	.53
				<u>2.11</u> Cost per meal
5	Roast Beef	16.23	13	1.25
	Corn	5.80	13	.45
	German Potato Salad	9.45	16	.59
	Blueberry Dessert	7.68	16	.48
				<u>2.77</u> Cost per meal

The cherry nut cake was made in the NLABS kitchen; for comparison purposes the cost per tray used here is an average of the other desserts.

Other Factors

The Tray Packs used are commercially available and routinely identified with paper labels. At Fort Devens, it was found that the labels come off the container and clog the filters in the circulating hoses. To preclude this, the labels were removed prior to placing them in the converter and the containers labeled with an indelible marker for identification of the contents.

At this evaluation the water was changed daily to avoid the problem of discoloration. In the production model the heat transfer coils should be stainless steel or copper.

As noted earlier, the converter should be insulated to avoid unnecessary heat loss. The serving table should also be insulated to keep the Tray Packs warm and to eliminate the present practice of taking hot water from the converter to keep the Tray Packs hot. The taking of water lowers the water level and decreases the heating capability. The lack of gaskets on the converter also contributed to water loss. At this evaluation ten gallons of water had to be replaced.

Improvements were made on the MFSU between evaluations to make it easier to handle the hot Tray Pack containers. The top of the converter was hinged so that half the cover could be raised to reach the Tray Pack. The operators suggested that it be further modified to open in fourths. An insulated container was added to hold additional Tray Pack, opened or unopened, so the server could easily reach a replacement Tray Pack rather than have to climb aboard the trailer for one. The operators suggested that the insulated container be a pass-through version and that the opener be mounted near the Tray Pack converter rather than on the serving table thereby eliminating the process of climbing on and off the trailer and walking from the front of the trailer to the back. This would also preclude delays on the serving line due to the opening of containers on the serving table. The duties of the cooks would be clearly defined with one serving and one backing up. This system would, by opening containers ahead of the time needed, allow the backup cook more time to check and replenish disposables, bread, beverages, condiments, etc.

The generator used on this evaluation was a commercial model and was noticeably more quiet than the military model. A larger fuel reservoir is desirable to eliminate frequent refills.

As early as 1750 hours, it was dark so that lights were required; the unit is not now equipped with lights. The cooks used hand-held flashlights which were cumbersome and slowed down the operation.

The location of the beverage containers slowed the operation of the serving. Originally located on the back of the trailer after the serving table, they were relocated to the side of the trailer on a table which also held the condiments.

The trailer used was equipped with a fabric cover over the serving lines to keep the operators and customers dry during wet weather. The concept worked well; however, it should be designed to allow it to be erected more quickly. Also a cover between the trailer and the MFSU would

be desirable. Covers on the sides of the trailer are highly desirable to protect the customers when they are picking up supplemental items or consuming a meal.

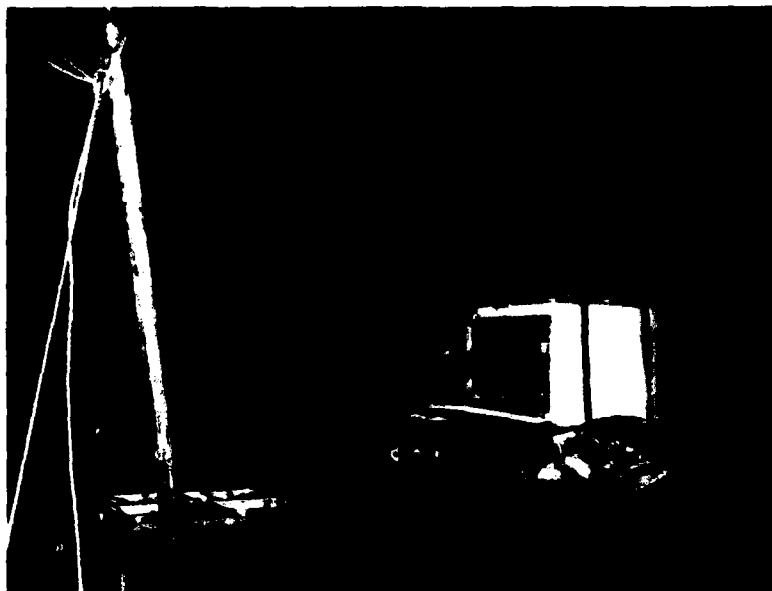


Figure 6. Weather Protection on MFSU

A ramp between the tow vehicle and trailer would improve safety and increase efficiency.

At present there is no cover available for Tray Pack containers. Such protection is desirable to retain heat and to protect the food from airborne contaminants. As pictured below the cooks used plastic bags for protection.



Figure 7. Protective Covering for Serving Table

Excessive liquid was again noted in the Tray Pack containers. This hot liquid spilled with each opening of a container creating a safety hazard and a mess requiring timely cleaning.

The serving table requires a leveling device to prevent spills on uneven ground.

The operating switches are now in separate locations. It would aid the operator if they were centrally located for easy access. The unit could then be activated or inactivated without having to climb up and over the components.

The unit, the 319th Artillery is not equipped with a 2½-ton truck. One was borrowed to tow the 1½-ton trailer. The unit has only gamma goats which adequately pull a ¾-ton trailer but struggle with a 1½-ton trailer over a rough terrain.

IV. CONCLUSIONS AND RECOMMENDATIONS

Based on this evaluation it can be reasonably concluded that the MFSU can be operated by just two food service personnel, and actually was operated during the five-day period by two cooks. The T-ration meal is highly acceptable to Army troops as attested to by the high hedonic ratings received from troops eating the T-ration meal in the field. The experimental prototype MFSU operated to expectations; there were no problems in the heating of the rations or in the reliability of the equipment.

Further, based upon these conclusions and the evaluation results, the following recommendations are warranted:

1. Tray Pack foods have a place in military field feeding based on their demonstrated adaptability to the needs found in the field. That is, they require only to be heated and opened to be served, they require no refrigeration and are highly acceptable to the customer. Thus, Tray Packs should be used in field exercises at every opportunity so that experience in their use is gained. This should facilitate the change from the current to the new system and offer combat troops the best field food service available.

2. Based on the experience gained in this and in other field evaluations of the experimental prototype MFSU, plans should be made to field evaluate the contractor's prototype at the earliest possible time so as to make best use of experience gained during this evaluation.

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